

REMARKS

At the outset, Applicants wish to thank the Examiner for his courtesy in granting a telephonic interview on February 20, 2003.

Claims 1-4, 6-13, 15-17 and 19-21 are pending in the application. Claims 1, 6 and 20 are amended in this response. Claim 21 has been added. Claims 2-4, 7-13, 15-17 and 19 remain unchanged. Claims 5, 14 and 18 were cancelled in a previous response.

Claim 20 stands rejected under 35 USC §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 20 also stands rejected under 35 USC §112, first paragraph, as not reasonably providing enablement for “essentially none of the titanium in the Ti(IV) state is converted to the Ti(III) state during reduction”.

In response, claim 20 has been amended to recite that “substantially none of the titanium in the Ti(IV) state is converted to the Ti(III) state during reduction.” Support for this amendment can be found, for example, beginning at page 9, line 13, page 10, line 3, page 11, line 19, page 12, line 11 and page 13, line 5 of the specification, as amended. Herein, the specification recites “reducing the oxidized slag in a reducing atmosphere from about 700°C to about 950°C for at least 5 minutes, to convert a major portion of the iron in the Fe(III) state to the Fe(II) state and *without converting a substantial amount of the titanium in the Ti(IV) state to the Ti(III) state.*” (emphasis added). Claim 20, as amended, now more closely tracks the language of the specification and is properly supported thereby. Furthermore, as provided in the MPEP §2173.5(e), “[t]here is no requirement that the words in the claim must match those used in the specification disclosure. Applicants are given a great deal of latitude in how they choose to define their invention so long as the terms and phrases used define the invention with a reasonable degree of clarity and precision.”

Claim 20 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "substantially" may be used to described a particular characteristic of a claimed invention so long as the limitation is definite in view of the specification. MPEP §2173.05(b). In view of the above, we submit that the objections by the Examiner to claim 20 have been fully addressed.

Claims 1-4, 6-13, 15-17, 19, 20 stand rejected under 35 USC §103(a) as being unpatentable over Borowiec et al. U.S. 5,830,420 (Borowiec) or WO 97/19199 (WO '199). We respectfully traverse.

Applicants submit that neither Borowiec nor WO '199, whether taken alone, or in combination, teach or suggest "stabilizing an anatase phase in the slag, causing the iron present in the slag to concentrate at the exposed surfaces of the slag particles, causing a major portion of the iron in the Fe(II) state to convert to the Fe(III) state, and causing the titanium in the Ti(III) state to be converted to the Ti(IV) state" as now more clearly claimed.

In particular, Borowiec and WO '199 do not teach or suggest stabilizing an anatase phase when the oxidation step is carried out below 900°C or 950°C. These references, in fact, teach away from oxidation temperatures below 900°C for upgrading titania slag, since each discloses that oxidation has to be above 950°C and that oxidation is preferably carried out between 1000°C and 1100°C. Moreover, in the disclosed examples of Borowiec and WO '199 the oxidations step was carried out above 1000°C.

Examples 12 and 13 of the Borowiec and WO '199 disclose the oxidation of SORELSLAG™ at 850°C and 900°C, respectively. However, both examples clearly teach the inapplicability of the conditions to upgrade ilmenite slag. These examples teach that when titania slags are oxidized, reduced and leached according to the conditions as set out therein, then substantially no upgrading of the titania slag is achieved. Accordingly, these specific examples teach away from the process according to the present invention. A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates v. Garlock, Inc.* 721 F.2d 1540, 220 USPQ 303 (Fed Cir. 1983); MPEP §2141.02.

On this basis, we submit that all of the claims pending in this application, are distinguishable over Borowiec and WO '199 and therefore in condition to be allowed.

Moreover, the claims of the present invention are limited to a method of treating titania slag including stabilizing an anatase phase. The formation of such an anatase phase, which is retained after reduction, is critical when titania slag is oxidized at lower temperatures and distinguishes the process according to the present invention over Borowiec and WO '199. A slag treated wherein an anatase phase is stabilized during oxidation of a slag at the temperature range as claimed, can be leached under softer conditions compared to the teaching of Borowiec WO '199. That is, treated slags wherein an anatase phase stabilizes during oxidation can be leached at atmospheric pressure, whereas in Borowiec and WO '199, where no anatase phase is formed, leaching has to take place at pressures above atmospheric pressure. The reason why treated slags wherein an anatase phase is stabilized during oxidation can be leached easier than treated slags wherein an anatase phase did not stabilize is not clear, but it is indeed so. In general, the process according to the present invention shows that an anatase phase can be stabilized in titania slags oxidized from 700°C to 900°C.

Rather, it is submitted that examples 12 and 13 of Borowiec and WO '199 do not teach or suggest the stabilization of an anatase phase. If an anatase phase stabilized, improved TiO₂ upgrading of the slag would have been obtained in contrast to the upgrading to 80.15% or 81.85% as recited in Borowiec and WO '199. The formation of a stable anatase phase is not a result, but is in fact a positive step as now recited in amended claims 1 and 6. In general, neither Borowiec nor WO '199, teach or suggest the formation of the anatase phase.

Furthermore, amended claim 6 includes the limitation that the TiO₂ content is increased to at least 90% by weight. Neither Borowiec nor WO '199, alone or in combination, teach or suggest this limitation. In contrast, as stated above, examples 12 and 13 of Borowiec and WO '199 recite a TiO₂ content at only 80.15% and 81.85%, respectively, were obtained. The upgraded titania slags of the process according to the process of the present invention is especially intended for the chloride process for titanium dioxide pigment production where TiO₂ content of 90% and above is required. When titania slag is treated such that an anatase phase is stabilized, such slags can be leached under the conditions as recited in claim 6. Neither Borowiec nor WO '199, alone or in combination, teach or suggest leaching of titania slag at atmospheric pressure.

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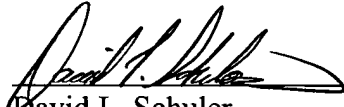
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Finally, new dependent claim 21 includes the limitation that a specific type of slag, titania slag comprising ilmenite beach sand, is subject to the invention. Borowiec and WO '199 do not teach or suggest that an anatase phase will stabilize in ilmenite beach sand when oxidized at a temperature from 700°C to 900°C, with the attendant benefit of improved suitability for chloride process for titanium dioxide pigment production for this type of slag.

Attached is a marked-up version of the changes being made by the current amendment, together with a check in the amount of \$18.00 for excess claims fees. Applicants submit that this application is now in condition for allowance. Early favorable action is solicited. Please apply any other charges or credits to Deposit Account No. 06-1050, Attorney Docket No. 12683-003001.

Respectfully submitted,

Date: February 20, 2003

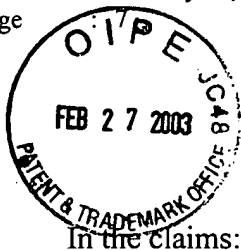


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Version with markings to show changes made

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In the Claims:

Claims 1, 6 and 20 have been amended as follows:

--1. (Thrice Amended) A method of treating titania slag to increase the leachability of impurities from the slag comprising the steps of:

sizing the titania slag to a particle size from 75 to 850 μm ;

oxidizing the sized slag particles in an oxidizing atmosphere at a temperature from about 700°C to below about 900°C for at least 30 minutes;

[causing] ^{New} stabilizing an anatase phase [to stabilize] in the slag, causing the iron present in the slag to concentrate at the exposed surfaces of the slag particles, causing a major portion of the iron in the Fe(II) state to convert to the Fe(III) state, and causing the titanium in the Ti(III) state to be converted to the Ti(IV) state; and

reducing the oxidized slag in a reducing atmosphere from about 700°C to about 950°C for at least 5 minutes to convert a major portion of the iron in the Fe(III) state to the Fe(II) state.--

--6. (Thrice Amended) A method of beneficiating titania slag to increase the TiO_2 content thereof to at least 90% by weight comprising the steps of:

sizing the titania slag to a particle size from 75 to 850 μm ;

oxidizing the sized slag particles in an oxidizing atmosphere at a temperature from about 700°C to below about 900°C for at least 30 minutes;

[causing] ^{New} stabilizing an anatase phase [to stabilize] in the slag, causing the iron present in the slag to concentrate at the exposed surfaces of the slag particles, causing a major portion of the iron in the Fe(II) state to convert to the Fe(III) state, and causing the titanium in the Ti(III) state to be converted to the Ti(IV) state;

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reducing the oxidized slag in a reducing atmosphere from about 700°C to about 950°C for at least 5 minutes to convert a major portion of the iron in the Fe(III) state to the Fe(II) state; and

leaching the reduced slag with acid to obtain a beneficiated slag product with an increased TiO₂ content and leach liquor containing the leached impurities.--

--20. (Amended) The method of claim 1 or 6 wherein [essentially] substantially none of the titanium in the Ti(IV) state is converted to the Ti(III) state during reduction.--